

## **Personal Experience Summary of DR. GARY S. SETTLES**

### **PERSONAL**

Office: 301D Reber Bldg., University Park, PA 16802; (814) 863-1504. Home: 2053 Valley View Road, Bellefonte, PA 16823; (814) 355-7093. Born October 9, 1949. Citizenship: USA. Married.

### **EDUCATION**

- Princeton University, Ph.D., January 1976, Aerospace and Mechanical Sciences.
- University of Tennessee (Knoxville), B.S. 1971, Mechanical and Aerospace Engineering.
- Maryville High School, Maryville, TN, graduated 1967.

### **EXPERIENCE**

July 1983 to present: Pennsylvania State University, Mechanical Engineering Dept., University Park, PA: Professor and Director, Gas Dynamics Laboratory. Established Gas Dynamics Laboratory for experimental high-speed fluid dynamics research. Principal Investigator of research grants from NASA, AFOSR, ONR, DOE, NSF, FAA and several industries totaling over \$500,000/year on atomization and sprays, environmental fluid dynamics, explosive detection technology, shock/boundary layer interaction phenomena, supersonic mixing and vortex breakdown, flow visualization, industrial clean-room fluid dynamics, and the gas dynamics of advanced materials and manufacturing processes. Taught ME 33 (Fluid Mechanics), ME 497C (Compressible Flow I, later ME 434), and ME 519 (Compressible Flow II). Supervised many MSE and Ph.D. students' research programs. Senior Member of the Graduate Faculty and former member of the PSU Graduate Council.

May 1977 to July 1983: Princeton University, Mechanical and Aerospace Engineering Department, Princeton, NJ: Research Engineer and Lecturer; Manager, Gas Dynamics Laboratory. Co-Principal Investigator on several experimental studies of two- and three- dimensional turbulent boundary layer/shock wave interaction flows. Manager of Gas Dynamics Laboratory operations, contracts, and staff. Supervised the research programs of seven graduate and two undergraduate students. Taught the Laboratory section of MAE 335 (Compressible Fluid Flow), and MAE 512 (Experimental Methods).

July 1975 to May 1977: Princeton Combustion Laboratories, Division of Flow Research, Inc., Princeton, NJ: Research Scientist. Project Leader of a study to define a national program in energy-efficient pump utilization; duties involved technical contribution to the study, project management, supervision and coordination of the work of a ten-member Technical Consulting Group. Co-investigator on experimental projects involving the design, construction, and operation of a ballistic-piston gas compressor and the detonation of a fuel-air cloud by means of pyrophoric compounds. Investigator of a study of handling sensitivity of malfunctioned primers, involving high-speed photographic observation of explosive events.

July 1971 to July 1975: Princeton University, Aerospace and Mechanical Sciences Department, Gas Dynamics Laboratory, Princeton, NJ: Assistant in Research and Teaching. Involved in graduate program of study and research leading to the Ph.D. degree; Research topic: compressible turbulent boundary layers, shock wave interactions, and flow separation; Advisor: Prof. S. M. Bogdonoff. Served as teaching assistant in undergraduate fluid mechanics and thermodynamics courses.

Summer 1970: NASA Ames Research Center, Air-Breathing Propulsion Branch, Moffett Field, CA: Engineering Aide. Developed and applied two new optical flow measurement techniques to experiments in supersonic and hypersonic airflows. Was involved with work on numerical codes for turbulent boundary layer prediction and hypersonic testing of airbreathing inlet configurations.

Summer 1968 and 1969: The Boeing Company, Commercial Airplane Division, SST Aerodynamics Group and Advanced 747 Configurations Group, Seattle, WA: Student Engineer. Involved in analysis and test planning for elastic forebody loads and crossflow lift of the supersonic transport. Involved in wing and airfoil design and wind tunnel testing of the advanced 747 airplane configuration. Carried out design study for wing tip tank installation on 747.

Summer 1967: U. S. Naval Ordnance Laboratory, Aeroballistics Division, White Oak, Silver Spring, MD: Physical Science Aide. Involved in high speed wind tunnel testing and optical flow analysis. Assisted with experiments carried out in supersonic and hypersonic wind tunnels, shock tube, and aeroballistic range.

## HONORS AND AWARDS

1966 - Named to Honors Group, Westinghouse Science Talent Search

1967 - Awarded 3rd Place, NASA Award, Air Force Achievement Award, and Navy Science Cruiser Award at the International Science Fair, San Francisco, CA.

- Awarded ALCOA Scholarship

- Appointed by Governor of Tennessee as State Delegate to National Youth Science Camp, Greenbank, WV.

1970 - Awarded AIAA National Undergraduate Student Award for research in flow visualization.

1971 - Awarded NSF Traineeship

1986 - Awarded Penn State Engineering Society (PSES) Award for Outstanding Research

1986 - Awarded AIAA Service Citation for Associate Editorship of AIAA Journal, 1983-1985.

1986 - "Outstanding Young Men of America" Award

1987 - Elected Associate Fellow of AIAA

1990 - Awarded Departments Head's Outstanding Faculty Award, M.E. Dept., Penn State

1992 - Awarded Penn State Engineering Society (PSES) Premiere Researcher Award

2003 - Paper of the Year Award, *Journal of Thermal Spray Technology*, (with co-authors T. C. Hanson and C. M. Hackett)

2004 – ASME Freeman Scholar Award

2004 – Awarded the Tsuyoshi Asanuma Award for Outstanding Achievement in Flow Visualization by the Visualization Society of Japan

2005 – Award for Excellent Visualized Image in 2005 (Full-scale schlieren image of a rifle discharge) by the Visualization Society of Japan

2007 – Given the title of Distinguished Professor by Penn State University

2007 – Awarded the Science Writing Award for Professionals in Acoustics by the Acoustical Society of America

## PROFESSIONAL SOCIETIES/ACTIVITIES

Member: American Institute of Aeronautics and Astronautics (AIAA, Associate Fellow), American Society of Mechanical Engineers (ASME), Sigma Xi, American Physical Society (APS), Society of Photo-Optical Instrumentation Engineers (SPIE), Intl. Soc. for the Arts, Sciences and Technology (ISAST), American Society of Engineering Education (ASEE), American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)

○ AIAA: Associate Editor, AIAA Journal, 1983-85. General Chairman, AIAA 16th Fluid & Plasma Dynamics Conference, 1983. Member of Fluid Dynamics Technical Committee 1980-83. Treasurer, Princeton Section 1980-82. Past Technical Program Committee Member, Conference Session Chairman, and Reviewer for numerous AIAA meetings and publications since 1974. National Student Award Winner 1970. Elected Associate Fellow 1987.

○ Member of AGARD Working Group 18 - Subcommittee on Shock Wave/Boundary-Layer Interaction and Transition, 1991-1993.

○ Member of the Supersonic Tunnel Association, 1977-1983 and 1989-1994.

○ Member of International Program Committee, 3<sup>rd</sup> through 13<sup>th</sup> International Symposia on Flow Visualization, 1983-2008.

## PAST AND PRESENT INDEPENDENT RESEARCH ACTIVITIES

○ President of FLOVIZ, Inc., a small business devoted to research and engineering in fluid dynamics.

○ Consultant to United Technologies Research Center on transonic shock wave/boundary layer interactions and flow visualization for wind tunnel testing.

○ Consultant to IBM Corp. on clean-room aerodynamics, flow visualization, and contamination control.

○ Consultant on 3-dimensional flow visualization to the Boeing Aerodynamics Laboratory.

○ Consultant to the Singer Co., American Meter Division, on the development of a natural gas energy meter.

○ Consultant to Ketron, Inc., on the fluid mechanics of mine ventilation.

○ Consultant to Nassau Research, Inc., on fluid flow problems of acetylene torches.

○ Consultant to Princeton Combustion Research Laboratories on problems of industrial energy conservation and experimental and computational fluid mechanics.

○ Consultant to the Rosenblad Corporation on the fluid mechanics of large industrial equipment.

○ Consultant to Ion Track Instruments on airborne sampling of trace explosives

○ Author of many articles on engineering and physics for The Academic American Encyclopedia and Collier's Encyclopedia.

○ Contributor on scientific photography, fluid mechanics, and combustion to various publications, museum exhibits, films, and television series including Scientific American, OMNI, Science Digest, Science et Vie, Newsweek, the Franklin Institute, the award-winning film "Search for Solutions", the CBS science series "Universe", the NBC "Today Show," and CNN's "Science News." Schlieren photography work was also featured in the series "Scientific Imagery", on German Public Television (NDR), and in The Learning Channel's Series "Body Atlas." Most recently, the world's largest stereoscopic schlieren system was set up to produce footage for the 1997

3D IMAX film "Hidden Dimension" Color schlieren photographs of the human cough, gunshots, and other phenomena have been reproduced in hundreds of books, magazines, and newspapers around the world.

#### **JOURNAL AND PROPOSAL REVIEWER**

AIAA Journal  
European Journal of Physics  
Experiments in Fluids  
Journal of Biochemical and Biophysical Methods  
Journal of Fluid Mechanics  
Journal of Fluids Engineering  
Journal of Thermal Spray Technology  
Journal of Turbulence  
Measurement Science and Technology  
NSF Chemical & Thermal Systems  
Optical Engineering  
Review of Scientific Instruments  
Particle and Particle Systems Characterization  
Shock Waves  
US Dept. of Energy Basic Energy Sciences Program

#### **INVITED LECTURES AND SEMINARS**

○ Seminar entitled "A Review of Experimental Research at the Princeton Gas Dynamics Laboratory", was presented in various versions at:

- California Institute of Technology (February 1981)
- United Technologies Research Center (March 1981)
- University of Tennessee Space Institute (August 1981)
- University of Texas (January 1982)
- Lockheed-Georgia Co. (August 1982)
- Pennsylvania State University (March 1983)

○ Invited Survey Lecture entitled "The State-of-the-Art of Conventional Flow Visualization Techniques for Wind Tunnel Testing," presented at the NASA Workshop on Flow Visualization and Laser Velocimetry for Wind Tunnels, Hampton VA, March 1982.

○ Seminar entitled "Some Unusual Fluid Phenomena Visualized by the Schlieren Technique", presented at Rutgers University, October 1982.

○ Invited Keynote Lecture on "Flow Visualization Techniques for Practical Aerodynamic Testing," Presented at the Third International Symposium of Flow Visualization, Ann Arbor, MI, September 1983.

○ Seminar entitled "White-Light Psuedo-Color Encoding Optics for Flow Visualization," presented at Penn State Electrical Engrg. Dept., October 1983.

○ Invited Survey Lecture entitled "Modern Developments in Flow Visualization," presented at AIAA 17th Fluid and Plasma Dynamics and Lasers Conference, Snowmass, CO, June 1984.

○ Invited Lectures on Shock/Boundary Layer Interactions and Flow Visualization were presented at the Beijing Institute of Aeronautics and Astronautics and the Beijing Institute of Aerodynamics, Beijing, China, July 1984.

○ Seminar Entitled "Visualization of Human Aerobiological Flows," presented at Hershey Medical Center, October 1984, and Penn State Chemical Engrg. Dept., February 1985.

○ Seminar entitled "Color Schlieren Flow Visualization and Applications", presented at San Diego State University, Fall, 1985.

EXHIBIT A

- Invited lecturer, University of Michigan Summer Short Course entitled, "Flow Visualization Techniques: Principles and Applications", yearly, 1986 to 1990.
- Invited Paper (AIAA 86-1099), "Recent Skin Friction Techniques for Compressible Flows," presented at AIAA/ASME 4th Fluid Mechanics, Plasma Dynamics, and Lasers Conference, Atlanta, GA, May 1986.
- Invited Lecture on "Flow Visualization: Images from Thin Air," presented at Meeting of SAE Williamsport, PA Group, April 1986.
- Invited Seminar entitled "Flow Visualization in Microelectronics Manufacturing," presented at the IBM Thomas J. Watson Research Center, September 1987, and at IBM Federal Systems Division, October 1987.
- Invited seminar entitled "Shock/Boundary Layer Interactions, Flow Visualization, and Instrumentation," presented at the USAF Arnold Engineering Development Center, Tullahoma, TN, March 1987.
- Lehigh University Seminar in Engineering Science, "Application of Schlieren Optics in Fluid Mechanics and Heat Transfer," Feb. 20, 1987.
- Invited Paper entitled "Visualization of High-Speed Flows at the Penn State Gas Dynamics Laboratory," presented at the 1988 International Conference on Applications of Lasers and Electro-Optics, Santa Clara, Oct. 30, 1988, with Metwally, O. M., Hsu, J. C., and Lu, F. K.
- Invited Paper entitled "Swept Shock/Boundary-Layer Interactions -- Tutorial and Update," Invited AIAA Paper 90-0375, presented at the AIAA 28th Aerospace Sciences Meeting, Reno, NV, January 1990, co-authored with D. S. Dolling
- Seminar entitled "Swept Shock/Boundary-Layer Interactions and Their Control", was presented at the Boeing Aircraft Co., Seattle, April 1991, and at NASA-Lewis research Center, June 1991.
- Seminar entitled "A Review of Research at the Penn State Gas Dynamics Laboratory", was presented at:
  - Institute Saint-Louis, France (August 1991)
  - ONERA Chalais-Meudon Laboratory (August 1991)
  - DLR-Gottingen (August 1991)
- Seminar entitled "Schlieren Visualization of the Human-Body Thermal Plume," Mechanics & Fluid Mechanics Colloquium, Essen University, Germany, May 5, 1993.
- Keynote Lecturer in NATO/AGARD Special Course on Shock Wave/Boundary Layer Interactions in Supersonic and Hypersonic Flows," Brussels, Belgium, 24-28 May, 1993.
- Panelist, NSF National Young Investigator Selection (Fluid, Particulate, and Hydraulic Systems), March 1994.
- Seminar entitled "Schlieren and Shadowgraph Techniques; Whence They Come and Where They Are Headed," College of Engineering, Florida State University/Florida A&M University, Tallahassee FL, Jan. 14, 1998.
- Invited Lecture entitled "Non-Traditional Fluid Dynamics: Adventures Beyond the Realm," presented at:
  - American Physical Society, Division of Fluid Dynamics, 51<sup>st</sup> Annual Meeting, Nov. 22-24, 1998, Philadelphia, PA
  - Stanford University, Mechanical Engineering Dept., March 10, 1999.
  - University of Minnesota, Mechanical Engineering Dept., April 14, 1999.
  - Florida State and Florida A&M Universities, College of Engineering, Tallahassee, FL, April 17, 2001
  - University of Florida, Mechanical and Aerospace Engrg. Dept., March 18, 2004
- "Flow Visualization: New Tricks for an Old Dog" lecture presented at Bucknell University, Nov. 5, 1999.

## EXHIBIT A

○ Mechanical & Nuclear Engineering Faculty Distinguished Lecture, Jan. 24, 2002, "Seeing the Invisible at Penn State: A 20-Year Retrospective," Penn State University

○ The Joy Goodwin Lecture, entitled "The External Aerodynamics of Canine Olfaction," presented at the Auburn University College of Veterinary Medicine on March 5, 2002.

○ Seminar entitled "Shock Waves in Aviation Security and Safety," University of Virginia, October 18, 2001.

○ NASA Langley Research Center Colloquium, "Shock Waves in Aviation Security and Safety," Tuesday, June 4, 2002.

○ Sigma Public Lecture Series Presentation, "Shock Waves in Aviation Security and Safety," Tuesday, June 4, 2002, Virginia Air & Space Center, Hampton, VA.

○ Settles, G. S., "True Confessions of an Experimentalist," Invited Paper # 2003-4271, presented at AIAA Fluid Dynamics Conference, Orlando, FL, June 26, 2003.

○ "Sniffers," ASME Freeman Scholar Lecture, presented at the ASME IMECHE Conference, Anaheim CA, Nov. 2004. Also presented as an invited lecture at Syracuse University, Nov. 4, 2005.

○ Invited Lecture "High-speed imaging of shock waves, and small-scale blast testing of materials," presented at Lehigh University, April 7, 2006. A version of this lecture co-authored by student M. J. Hargather was also given at the US Army Research Laboratory in June 2006.

○ Invited Lecture entitled "The Aerodynamics of Canine Olfaction," presented at UC Berkeley, Neuroscience Dept., Oct. 2, 2006.

○ The William C. Reynolds Memorial Lecture, entitled "Fluid Mechanics and Homeland Security," presented at Stanford University Oct. 5, 2006.

○ Invited Lecture entitled "Sniffing Like a Dog to Improve Air Sensors," presented at Syracuse University, Oct. 30, 2006.

○ Invited Lecture entitled "The Aerodynamics of Canine Olfaction," presented at the *Gordon Research Conference on Detecting Illicit Substances: Explosives and Drugs*, September 16-21, 2007, Big Sky, Montana

## PATENTS

○ US Patent 5,578,581, G.S. Settles, Inventor, entitled "Supersonic Abrasive Iceblasting Apparatus," July 28, 1998, assigned to the Penn State Research Corp.

○ US Patent 5,975,996, G.S. Settles, Inventor, entitled "Abrasive Blast Cleaning Nozzle," November 2, 1999, assigned to the Penn State Research Foundation.

○ US Patent 6,073,499, G.S. Settles, Inventor, entitled "Chemical trace detection portal based on the natural airflow and heat transfer of the human body," June 13, 2000, assigned to the Penn State Research Foundation.

○ US Patent 6,171,656, G.S. Settles, Inventor, entitled "Method and apparatus for collecting overspray," Jan. 9, 2001, assigned to the Penn State Research Foundation.

## PUBLICATIONS

- M. J. Hargather, G. S. Settles, L. J. Dodson-Dreibelbis, and T. J. Liebner, "Natural-background-oriented schlieren imaging" to be presented at the 13th International Symposium on Flow Visualization, Nice, France, July 1-4, 2008.
- G. S. Settles, M. J. Hargather, M. J. Lawson, R. P. Bigger, and M. J. Madalis, "Schlieren imaging of shock waves in air at the extreme weak limit" to be presented at the 13th International Symposium on Flow Visualization, Nice, France, July 1-4, 2008.
- M. J. Lawson, G. S. Settles, J. D. Miller, and L. M. Weinstein, 'Focusing-schlieren "PIV" of supersonic turbulent boundary layers,' to be presented at the 13th International Symposium on Flow Visualization, Nice, France, July 1-4, 2008.
- M. M. Biss, G. S. Settles, and S. R. Sanderson, "Differential schlieren-interferometry with a simple adjustable Wollaston-like prism," accepted for publication in *Applied Optics*, 2008.
- G. S. Settles and M. J. Lawson, "Schlieren velocimetry of turbulent flows (Invited)," to be presented at the AIAA 38<sup>th</sup> Fluid Dynamics Conference, Seattle, June 2008.
- M. J. Hargather and G. S. Settles, "Optical measurement and scaling of blasts from gram-range explosive charges." *Shock Waves* Vol. 17 No. 4, pp. 215-223, 2007.
- J. Porter, B. A. Craven, R. M. Khan, S. J. Chang, I. Kang, B. Judkewitz, B. Judkewicz, J. A. Volpe, G. S. Settles, and N. Sobel, "Mechanisms of scent-tracking in humans, *Nature Neuroscience* Vol. 10 No. 1, pp.:27-29, 2007.
- Julian W. Tang and Gary S. Settles, "Coughing and infectious aerosols – Seeing is believing," submitted to *New England Journal of Medicine*, May 2007
- H. Kleine and G. S. Settles, "The art of shock waves and their flowfields," accepted for publication in *Shock Waves*, Dec. 2007.
- B. A. Craven, T. Neuberger, G. S. Settles, E. G. Paterson, A. G. Webb, E. M. Josephson, and E. E. Morrison, "Reconstruction and morphometric analysis of the nasal airway of the dog (*Canis familiaris*) and implications regarding olfactory airflow," *Anatomical Record* Vol. 290 No. 11, pp.1325-1340, 2007.
- Michael J. Hargather, Gary S. Settles, and Joseph A. Gatto, "Gram-range explosive blast scaling and associated materials response," Proc. 26th International Symposium on Shock Waves, July 15th-20th 2007, Göttingen, Germany.
- M.M. Biss, M.J. Hargather, G.S. Settles, L.J. Dodson, and J.D. Miller, "High-speed digital shadowgraphy of shock waves from explosions and gunshots," Proc. 26th International Symposium on Shock Waves, July 15th-20th 2007, Göttingen, Germany.
- M. E. Staymates, G. S. Settles, K.-B. Shi, and Z.-W. Liu, "Supercontinuum laser illumination applied to traditional optical flow imaging methods," *Optics Communications*, Vol. 273, 2007, pp. 252-255.
- J. Porter, B. A. Craven, S.-J. Chang, I. Kang, B. Judkewicz, R. M. Khan, J. A. Volpe, G. S. Settles, and N. Sobel, "Mechanisms of scent-tracking," *Nature Neuroscience*, Vol. 10, No. 1, January 2007, pp. 27-29.
- M. J. Hargather, G. S. Settles, J. A. Gatto, "Optical measurement, characterization, and scaling of blasts from gram-range explosive charges," *Proc. 4th International Aviation Security Technology Symposium*, Washington, DC, November 28-December 1, 2006.

- M. J. Hargather, G. S. Settles, J. A. Gatto, T. P. Grumstrup, and J. D. Miller, "Full-scale optical experiments on the explosive failure of a ULD-3 air cargo container," *Proc. 4th International Aviation Security Technology Symposium*, Washington, DC, November 28-December 1, 2006.
- M. E. Staymates, D. J. Smith, and G. S. Settles, "The internal aerodynamics of cargo containers for trace explosives sampling," *Proc. 4th International Aviation Security Technology Symposium*, Washington, DC, November 28-December 1, 2006.
- G. S. Settles, "On the fluid dynamicist as artist," *Proc. 12th International Symposium on Flow Visualization*, September 10-14, 2006, Göttingen, Germany.
- G. S. Settles, G. Tremblay, J. M. Cimbala, L. J. Dodson, and J. D. Miller, "Fluid mechanics films in the 21st century," *Proc. 12th International Symposium on Flow Visualization*, September 10-14, 2006, Göttingen, Germany.
- B. A. Craven and G. S. Settles, "A computational and experimental investigation of the human thermal plume" *Journal of Fluids Engineering*, Vol. 128, No. 6, November 2006, pp. 1251-1258.
- J. A. Volpe and G. S. Settles, "Laser-induced gas breakdown as a light source for schlieren and shadowgraph 'PIV,'" *Optical Engineering*, Vol. 45, No. 8, Aug. 2006, pp. 080509-1 to 080509-3.
- D. R. Jonassen, G. S. Settles, and M. D. Tronosky, "Schlieren 'PIV' for turbulent flows," *Optics and Lasers in Engineering*, Vol. 44, No. 3-4, pp. 190-207, 2006.
- G. S. Settles, "High-speed imaging of shock waves, explosions and gunshots," *American Scientist*, Vol. 94, No 1, pp. 22-31, 2006.
- G. S. Settles, "Fluid mechanics and homeland security," *Annual Review of Fluid Mechanics*, Vol. 38, pp. 87-110, 2006.
- B. A. Edge, E. G. Paterson, and G. S. Settles, "Computational study of the wake and contaminant transport of a walking human," *J. Fluids Eng.*, Vol. 127, No. 5, pp. 967-977, 2005.
- G. S. Settles, T. P. Grumstrup, J. D. Miller, and J. A. Gatto, Full-scale high-speed Edgerton shadowgraphy of explosions and gunshots," *Proc. 5th Pacific Symposium on Flow Visualization and Image Processing*, Daydream Island, Australia, 27-29 September, 2005
- S. P. Mates and G. S. Settles, "Experiments on Liquid Metal Atomization Using Close-Coupled Nozzles, Part 1: Gas Dynamic Behavior," *Atomization and Sprays*, Vol. 15, No. 1, pp. 19-40, 2005.
- S. P. Mates and G. S. Settles, "Experiments on Liquid Metal Atomization Using Close-Coupled Nozzles, Part 2: Atomization Behavior," *Atomization and Sprays*, Vol. 15, No. 1, pp. 41-59, 2005.
- G. S. Settles, "Sniffers: Fluid-dynamic sampling for olfactory trace detection in nature and homeland security – The 2004 Freeman Scholar Lecture," *J. Fluids Eng.* Vol. 127, No. 2, pp. 189-218, 2005.
- G. S. Settles, L. J. Dodson, "Full-scale schlieren visualization of supersonic bullet and muzzle blast from firing a .30-06 rifle," *Journal of Visualization*, Vol. 8, No. 1, 2005, p. 6.
- G. S. Settles, T. P. Grumstrup, L. J. Dodson, J. D. Miller, and J. A. Gatto, "Full-scale high-speed schlieren imaging of explosions and gunshots," *Proc. 26th Intl. Conf. on High-Speed Photography and Photonics*, Alexandria, VA, Sept. 20-24, 2004, D. L. Paisley, ed., Bellingham, WA:SPIE Press. Paper 5580-174, pp. 60-68.



- G. S. Settles, "The Penn State Full-Scale Schlieren System," Proc. 11<sup>th</sup> International Symposium on Flow Visualization, ed. T. J. Mueller and I. Grant, Notre Dame University, August 2004, paper 76.
- Settles, G. S., Benwood, J. R., and Gatto, J. A., "High-Speed Cinematography of Internal Explosions for Aviation Security," presented at the 24<sup>th</sup> International Symposium on Shock Waves, Beijing, July 2004.
- B. H. Pandya, G. S. Settles, and J. D. Miller, "Schlieren Imaging of Shock Waves from a Trumpet," *J. Acoustical Soc. America*, Vol. 114 Part 1, No. 6, Dec. 2003, pp. 3363-3367.
- Hanson, T. C. and Settles, G. S., "Particle Temperature and Velocity Effects on the Porosity and Oxidation of an HVOF Corrosion-Control Coating," *Journal of Thermal Spray Technology*, Vol. 12, No. 3, Sept. 2003, pp.403-415.
- L. M. Weinstein and G. S. Settles, "Schlieren," Chapter 4 of *Optical Metrology for Fluids, Combustion, and Solids*, ed. C. Mercer, Kluwer Academic Press, July 2003, ISBN 1-4020-7407-7.
- Settles, G. S., Benwood, J. R., and Gatto, J. A., "Optical Shock Wave Imaging for Aviation Security," presented at the 4<sup>th</sup> ASME\_JSME Joint Fluids Engineering Conference, Honolulu, Hawaii, July 6-11, 2003
- Hartranft, T. J., and Settles, G. S., "Sheet Atomization of Non-Newtonian Liquids," *Atomization and Sprays*, Vol. 13, Nos. 2-3, March-June 2003, pp. 191-221.
- Settles, G. S., "True Confessions of an Experimentalist," Invited Paper # 2003-4271, AIAA Fluid Dynamics Conference, Orlando, FL, June 26, 2003.
- G. S. Settles, B. T. Keane, B. W. Anderson, and J. A. Gatto, "Shock waves in aviation security and safety," *Shock Waves*, Vol. 12, No. 4, Jan. 2003, pp.267-275.
- Settles, G. S., Kester, D. A., and Dodson-Dreibelbis, L. J., "The External Aerodynamics of Canine Olfaction," Chapter 23 of *Sensors and Sensing in Biology and Engineering*, ed. F.G. Barth, J.A.C. Humphrey, and T.W. Secomb, Springer, Vienna & NY, 2003, ISBN 3-211-83771-X, pp. 323-335.
- Hanson, T. C., Hackett, C. M., and Settles, G. S., "Independent Control of HVOF Thermal Spray Temperature and Velocity," *Journal of Thermal Spray Technology*, Vol. 11, No. 1, March 2002, pp. 75-85.
- Gary S. Settles, Heather C. Ferree, Michael D. Tronosky, and Zachary M. Moyer, and William J. McGann, "Natural Aerodynamic Portal Sampling of Trace Explosives from the Human Body," FAA 3<sup>rd</sup> International Symposium on Explosive Detection and Aviation Security, Nov. 26-30, 2001, Atlantic City, NJ.
- G.S. Settles, B.T. Keane, B.W. Anderson, and J.A. Gatto, "High-Speed Imaging of Shock-Wave Motion in Aviation Security Research," FAA 3<sup>rd</sup> International Symposium on Explosive Detection and Aviation Security, Nov. 26-30, 2001, Atlantic City, NJ.
- Settles, G. S., *Schlieren and Shadowgraph Techniques; Visualizing Phenomena in Transparent Media*, Springer-Verlag, Heidelberg, September 2001, ISBN 3540661557.
- Settles, G. S., and Kester, D. A., "Aerodynamic sampling for landmine trace detection," presented at SPIE Aerosense Meeting, Orlando, April 2001, SPIE Vol. 4394 paper 108.
- Settles, G. S., and McGann, W. J., "Potential for portal detection of human chemical and biological contamination," presented at SPIE Aerosense Meeting, Orlando, April 2001, SPIE Vol. 4378 paper 01.
- Settles, G. S., "Process Gas Nozzles," Section 4.8 of the *LIA Handbook of Laser Materials Processing*, ed. J. F. Ready & D. F. Farson, Laser Institute of America and Magnolia Publishing Inc., Orlando Florida, 2001, pp. 155-156.

- G. S. Settles, B. T. Keane, B. W. Anderson, and J. A. Gatto, "Shock waves in aviation security and safety," Proc. of the 23rd Intl. Symposium on Shock Waves, July 2001, Fort Worth, TX.
- Settles, G. S., "Airflow Visualization in a Model Greenhouse," Proc. Plasticulture 2000, Proc. 15th Intl. Congr. for Plastics in Agriculture, Hershey, PA, Sept. 2000, pp. 88-98.
- Kegerise, M. A., and Settles, G. S., "Schlieren Image-Correlation Velocimetry and its Application to Free-Convection Flows," presented at the 9<sup>th</sup> International Symposium on Flow Visualization, Edinburgh, Scotland, Aug. 2000.
- Gowadia, H. A., and Settles, G. S., "The Natural Sampling of Airborne Trace Signals from Explosives Concealed upon the Human Body," *Journal of Forensic Sciences*, Vol. 46, No. 6, Nov. 2001, pp. 1324-1331.
- S. P. Mates and G. S. Settles, "The Gas-Dynamic and Metal Atomization Performance of Two Different Close-Coupled Nozzles," in *Powder Materials: Current Research and Industrial Practices*, Ed. F.D.S. Marquis, The Minerals, Metals and Materials Society, Warrendale, PA, 1999, pp.19-38.
- Settles, G. S., "Imaging Gas Leaks by using Schlieren Optics," *Pipeline and Gas Journal*, Vol. 229, No. 9, September 1999, pp. 28-30.
- Settles, G. S., "Schlieren and Shadowgraph Imaging in the Great Outdoors," Proceedings of the 2<sup>nd</sup> Pacific Symposium on Flow Visualization and Image Processing, May 16-19, 1999, Honolulu, USA.
- Bemis, B. L., and Settles, G. S., "Ultraviolet Imaging of the Anode Attachment in Transferred-Arc Plasma Cutting," *IEEE Trans. on Plasma Science*, Vol. 27, No. 1, Feb. 1999, pp. 44-45
- Hartranft, T. J., and Settles, G. S., "High-Pressure Sheet Atomization of Non-Newtonian Fluids," Proceedings of the ILASS-Americas 12<sup>th</sup> Annual Conference on Liquid Atomization and Spray Systems, May 16-19, 1999, Indianapolis, IN.
- Garg, S., and Settles, G. S., "Measurements of a Supersonic Turbulent Boundary Layer by Focusing Schlieren Deflectometry," *Experiments in Fluids*, Vol. 25, No. 3, pp. 254-264, 1998.
- Settles, G. S., "HVOF Thermal Spray Velocity, Temperature, and Stainless Steel Coating Properties," presented at the 16<sup>th</sup> Symposium on Energy Engineering Sciences, Argonne National Labs, IL, May 13-15, 1998.
- Settles, G. S., Miller, J. D., Hartranft, T. J., and Brandt, A. D., "Visualization And Collection of Overspray from Airless Spray Painting," Proceedings of the 8<sup>th</sup> International Symposium on Flow Visualization, Sorrento, Italy, Sept. 1-4, 1998, Paper No. 138.
- Settles, G. S., Brandt, A. D., and Miller, J. D., "Full-Scale Schlieren Imaging of Shock Waves for Aviation Security Research," Proceedings of the 8<sup>th</sup> International Symposium on Flow Visualization, Sorrento, Italy, Sept. 1-4, 1998, Paper No. 30.
- Bemis, B. L., and Settles, G. S., "Visualization of Liquid Metal, Arc, and Jet Interactions in Plasma Cutting of Steel Sheet," Proceedings of the 8<sup>th</sup> International Symposium on Flow Visualization, Sorrento, Italy, Sept. 1-4, 1998, ed. G. Carlomagno, Paper No. 108.
- Settles, G. S., "Overspray Collection Technology for Robotic Spray Painting of Navy Ships," TM 97-137, Applied Research Laboratory, Penn State University, January 1998.
- Brandt, A. D., and Settles, G. S., "Effect of Nozzle Orientation on Gas Dynamics of Inert Gas-Laser Cutting of Mild Steel," *Journal of Laser Applications*. Vol. 9, No. 6., December 1997, p. 269ff.

- Naughton, J. W., Cattafesta, L. N. III, and Settles, G. S., "An Experimental Study of Compressible Turbulent Mixing Enhancement in Swirling Jets," *Journal of Fluid Mechanics*, Vol. 330 (1997), pp. 271-305.
- Settles, G. S., "Visualizing Full-Scale Ventilation Airflows," *ASHRAE Journal*, Vol. 39, No. 7, July 1997, pp. 19-26.
- Settles, G. S., "A Flow Visualization Study of Airless Spray Painting," Proceedings of the ILASS-Americas 10<sup>th</sup> Annual Conference on Liquid Atomization and Spray Systems, May 18-21, 1997, Ottawa, Canada, pp. 145-149.
- Scroggs, S. D., and Settles, G. S., "An Experimental Study of Supersonic Microjets," *Experiments in Fluids*, Vol. 21, pp. 401-409, 1996.
- Settles, G. S., Gowadia, H. A., S. B. Strine, T. E. Johnson, "The Natural Aerodynamic Sampling of Trace Explosives from the Human Body," Proc. of the 2<sup>nd</sup> FAA Symposium on Explosives Detection Technology and Aviation Security Technology Conference, 12-15 Nov. 1996, Atlantic City, NJ, ed. W. H. Makky, pp. 65-70.
- Settles, G. S., and Geppert, S. T., "Redesigning Blasting Nozzles to Improve Productivity," *Journal of Protective Coatings and Linings*, Vol. 13, No. 10, October 1996, pp. 64-72.
- Brandt, A., Scroggs, S. D., and Settles, G. S., "An Investigation of the Effect of Nozzle Design and Orientation on Gas Dynamic Interactions During Inert Gas-Laser Cutting of Mild Steel," presented at ICALEO'96, 14-17 Oct. 1996, Detroit, MI.
- Hackett, C. M. and Settles, G. S., "Independent Control of HVOF Particle Velocity and Temperature," Proceedings of the 9th National Thermal Spray Conference, ed. C. Berndt, ASM International, Materials Park, OH, Oct. 1996, pp. 665-673.
- Mates, S. P., and Settles, G. S., "High-Speed Imaging of Liquid Metal Atomization by Two Different Close-Coupled Gas Atomization Nozzles," presented at the 1996 World Congress on Powder Metallurgy and Particulate Materials, Washington DC, June 16-21, 1996.
- Garg, S., and Settles, G. S., "Unsteady Pressure Loads Generated by Swept Shock Wave/Boundary-Layer Interactions," *AIAA Journal*, June 1996, Vol. 34, No. 6, pp. 1174-1181.
- Garrison, T. J., Settles, G. S., Narayanswami, N., Knight, D. D., and Horstman, C. C., "Flowfield Surveys and Computations of a Crossing-Shock Wave/Boundary Layer Interaction," *AIAA Journal*, Vol. 34, No. 1, Jan. 1996, pp. 50-56.
- Garrison, T. J., Settles, G. S., and Horstman, C. C., "Measurements of the Triple Shock Wave/Turbulent Boundary Layer Interaction," *AIAA Journal*, Vol. 34, No. 1, Jan. 1996, pp. 57-64.
- Knight, D., Garrison, T., Settles, G., Zheltovodov, A., Maksimov, A., Shevchenko, A., and Vorontsov, S., Asymmetric Crossing Shock Wave - Turbulent Boundary Layer Interaction, *AIAA Journal*, Vol. 33, No. 6, Dec. 1995, pp. 2241-2249.
- Settles, G. S., Hackett, E. B., Miller, J. D., and Weinstein, L. M., "Full-Scale Schlieren Flow Visualization," in *Flow Visualization VII*, ed. J. P. Crowder, Begell House, New York, Sept. 1995, pp. 2-13.
- Hackett, C. M. and Settles, G. S., "Research on HVOF Gas Shrouding for Coating Oxidation Control," Proceedings of the 8th National Thermal Spray Conference, ASM International, Houston, September 11-15, 1995, pp. 21-29.

- Hackett, C. M. and Settles, G. S., "The Influence of Nozzle Design on HVOF Spray Particle Velocity and Temperature," Proceedings of the 8th National Thermal Spray Conference, ASM International, Houston, September 11-15, 1995, pp. 135-140.
- Connelly, J. M, Gatto, J. A., and Settles, G. S., "An Assessment of the Aerodynamic Efficiency of the CPAD Holdings Ltd. Explosives Detection Portal," US Dept. of Transportation Report DOT/FAA/CT-95/45, July 1995, FAA Technical Center, Atlantic City, NJ.
- Hackett, C. M. and Settles, G. S., "The HVOF Thermal Spray: Materials Processing from a Gas Dynamics Perspective," AIAA Paper 95-2207, AIAA 26th Fluid Dynamics Conference, San Diego, June 1995.
- Mates, S. P., and Settles, G. S., "A Flow Visualization Study of the Gas Dynamics of Liquid Metal Atomization Nozzles," 1995 International Conference on Powder Metallurgy and Particulate Materials, Seattle, May 14-17, 1995.
- Settles, G. S., and Garg, S., "A Scientific View of the Productivity of Abrasive Blasting Nozzles," *Journal of Protective Coatings and Linings*, April 1995, pp. 28-41, 101-102.
- Knight, D., Garrison, T., Settles, G., Zheltovodov, A., Maksimov, A., Shevchenko, A., and Vorontsov, S., Asymmetric Crossing Shock Wave - Turbulent Boundary Layer Interaction, AIAA Paper 95-0231, January 1995.
- Settles, G. S., and Garg, S., "A Scientific View of the Productivity of Abrasive Blasting Nozzles," Proceedings of the Steel Structures Painting Council 1994 International Conference, Atlanta, November 11-17, 1994, pp. 12-19.
- Hackett, C. M., Settles, G. S., and Miller, J. D., "On the Gas Dynamics of HVOF Thermal Sprays," *Journal of Thermal Spray Technology*, Vol. 3, No. 3, September 1994, pp. 299-304.
- Knight, D.D., Narayanswami, N., Garrison, T. J., and Settles, G. S., "Investigation of Crossing Shock Wave-Turbulent Boundary Layer Interaction," paper presented at Intl. Conf. on Methods of Aerophysical Research, Novosibirsk, Russia, August 22-24, 1994.
- Settles, G. S., and Dodson, L. J., "Supersonic and Hypersonic Shock/Boundary-Layer Interaction Database," *AIAA Journal*, Vol. 32, July 1994, pp. 1377-1383.
- Naughton, J. W., and Settles, G. S., "A Theoretical Framework for Mixing Layers Surrounding Compressible Turbulent Swirling Jets," AIAA Paper 94-2245, June 1994.
- Garrison, T. J., Settles, G. S., and Horstman, C. C., "Measurements and Computation of the Triple Shock Wave/Turbulent Boundary Layer Interaction," AIAA Paper 94-2274, June 1994.
- Garrison, T. J., Settles, G. S., Narayanswami, N., and Knight, D. D., "Laser-Interferometer Skin Friction Measurements of Crossing-Shock-Wave/Turbulent-Boundary-Layer Interactions," *AIAA Journal*, Vol. 32, June 1994, pp. 1234-1241.
- Garrison, T. J., Settles, G. S., Narayanswami, N., Knight, D. D., and Horstman, C. C., "Comparison of Flowfield Surveys and Computations of a Crossing-Shock Wave/Boundary Layer Interaction," AIAA Paper 94-2273, June 1994.
- Hackett, C. M. and Settles, G. S., "Turbulent Mixing of the HVOF Thermal Spray and Coating Oxidation," Proceedings of the National Thermal Spray Conference, Boston, June 20-24, 1994.
- Lee, Y., Settles, G. S., and Horstman, C. C., "Heat Transfer Measurements and Computations of Swept-Shock-Wave/Boundary-Layer Interactions," *AIAA Journal*, Vol. 32, No. 4, April 1994, pp. 726-734.

- Garrison, T. J., Settles, G. S., Narayanswami, N., and Knight, D. D., "Structure of Crossing Shock-Wave/Turbulent Boundary-Layer Interactions," *AIAA Journal*, Vol. 31, Dec. 1993, pp. 2204-2211.
- Settles, G. S., "Swept Shock/Boundary Layer Interactions - Scaling Laws, Flowfield Structure, and Experimental Methods" in *AGARD Report 792*, US North Atlantic Treaty Organization, Advisory Group for Aerospace Research and Development, August 1993, pp. 1-1 to 1-40.
- Garrison, T. J., Settles, G. S., Narayanswami, N., and Knight, D. D., "Laser-Interferometer Skin Friction Measurements of Crossing-Shock-Wave/Turbulent-Boundary-Layer Interactions," AIAA Paper 93-3072, July 1993.
- Knight, D.D., Horstman, C.C., Settles, G.S., and Zheltovodov, A.A., "3-D Shock Wave Turbulent Boundary Layer Interactions Generated by a Single Fin," Preprint 1-93, Institute of Theoretical and Applied Mechanics, Russian Academy of Sciences, Novosibirsk, June 23, 1993.
- Hackett, C. M., Settles, G. S., and Miller, J. D., "On the Gas Dynamics of HVOF Thermal Sprays," Proceedings of the National Thermal Spray Conference, Anaheim, CA, June 7-11, 1993.
- Naughton, J. W., Cattafesta, L. N. III, and Settles, G. S., "A Miniature, Fast-Response Five-Hole Probe for Supersonic Flowfield Measurements," *AIAA Journal*, Vol. 31, March 1993, pp. 453-458.
- Garrison, T. J., and Settles, G. S., "Interaction Strength and Model Geometry Effects on the Structure of Crossing Shock-Wave/Turbulent Boundary-Layer Interactions," AIAA Paper 93-0780, Jan. 1993.
- Naughton, J. W., and Settles, G. S., "Experiments on the Enhancement of Compressible Mixing via Streamwise Vorticity, Part I - Vortex Strength Assessment and Seed Particle Dynamics," AIAA Paper 93-0742, Jan. 1993.
- Alvi, F. S., Settles, G. S., and Weinstein, L. M., "A Sharp-Focusing Schlieren Optical Deflectometer," AIAA Paper 93-0629, Jan. 1993.
- Garg, S., and Settles, G. S., "Wall Pressure Fluctuations Beneath Swept Shock Wave/Boundary-Layer Interactions," AIAA Paper 93-0384, Jan. 1993.
- Knight, D. D., Badekas, D., Horstman, C. C., and Settles, G. S., "Quasiconical Flowfield Structure of the Three-Dimensional Single Fin Interaction," *AIAA Journal*, Vol. 30, Dec. 1992, pp. 2809-2816.
- Settles, G. S., "An Overview of Planar Laser Scattering for the Visualization of High-Speed Flows," in *Flow Visualization VI*, ed. Y. Tanida et al., Springer-Verlag, 1992, pp. 628-633.
- Alvi, F. S., and Settles, G. S., "Physical Model of the Swept Shock Wave/ Boundary-Layer Interaction Flowfield," *AIAA Journal*, Vol. 30, Sept. 1992, pp. 2252-2258.
- Zheltovodov, A. A., Borisov, A. V., Knight, D. D., Horstman, C. C., and Settles, G. S., "The Possibilities of Numerical Simulation of Shock Waves/Boundary layer Interaction in Supersonic and Hypersonic Flows," *Proc. Intl. Conf. on the Methods of Aerophysical Research*, Inst. of Theoretical and Applied Mechanics, Russian Academy of Sciences, Siberian Div., Novosibirsk, Russia, August 31- Sept. 4, 1992, pp. 164-170.
- Lee, Y., Settles, G. S., and Horstman, C. C., "Heat Transfer Measurements and CFD Comparison of Swept Shock Wave/Boundary-Layer Interactions," AIAA Paper 92-3665, July 1992.
- Garrison, T. J., Settles, G. S., Narayanswami, N., and Knight, D. D., "Structure of Crossing Shock-Wave/Turbulent Boundary-Layer Interactions," AIAA Paper 92-3670, July 1992.
- Naughton, J. W., and Settles, G. S., "Experiments on the Enhancement of Compressible Mixing via Streamwise Vorticity, Part I - Optical Measurements," AIAA Paper 92-3549, July 1992.

- Naughton, J. W., Cattafesta, L. N. III, and Settles, G. S., "A Miniature, Fast-Response 5-Hole Probe for Supersonic Flowfield Measurements," AIAA Paper 92-0266, Jan. 1992.
- Cattafesta, L. N. III, and Settles, G. S., "Experiments in Shock/Vortex Interaction," AIAA Paper 92-0315, Jan. 1992.
- Garrison, T. J., and Settles, G. S., "Flowfield Visualization of Crossing Shock-Wave/Boundary Layer Interactions," AIAA Paper 92-0750, Jan. 1992.
- Hsu, J. C., and Settles, G. S., "Holographic Flowfield Density Measurements in Swept Shock-Wave/Turbulent Boundary-Layer Interactions," AIAA Paper 92-0746, Jan. 1992.
- Kim, K-S, Lee, Y., Alvi, F. S., and Settles, G. S., "Skin-Friction Measurements and Computational Comparison of Swept Shock/Boundary-Layer Interactions," *AIAA Journal*, Vol. 29, October 1991, pp. 1643-1650.
- Kim, K-S, Lee, Y., and Settles, G. S., "Laser Interferometer/Preston Tube Skin-Friction Comparison in Shock Boundary-Layer Interaction," *AIAA Journal*, Vol. 29, June 1991, pp. 1007-1008.
- Horstman, C. C., Settles, G. S., and Dodson, L. J., "Hypersonic Shock-Wave Turbulent Boundary-Layer Interaction Flows: Experiment and Computation," Paper # 209, 10th National Aerospace Plane Symposium, April 1991.
- Settles, G. S., and Dodson, L. J., "Hypersonic Shock/Boundary-Layer Interaction Database," NASA CR 177577, 1991.
- McIntyre, S. S., Stanewsky, E., and Settles, G. S., "An Optical Deflectometer for Turbulence Measurements," Proceedings of the 14th ICIASF Congress, Rockville, MD, Oct. 27-31, 1991.
- Settles, G. S., and Dodson, L. J., "Hypersonic Shock/Boundary-Layer Interaction Database," AIAA Paper 91-1763, June 1991.
- McIntyre, S. S., and Settles, G. S., "Optical Experiments on Compressible Turbulent Mixing Layers," AIAA Paper 91-0623, presented at the AIAA 29th Aerospace Sciences Meeting, Reno, NV, January 1991.
- Knight, D. D., Settles, G. S., and Horstman, C. C., "3-D Shock Wave-Turbulent Boundary-Layer Interaction Generated by a Sharp Fin at Mach 4," AIAA Paper 91-0648, presented at the AIAA 29th Aerospace Sciences Meeting, Reno, NV, January 1991.
- Settles, G. S., Alvi, F. S., and Hsu, J. C., "On the Shock-Bifurcation/Jet-Impingement Structure of Swept Interactions and related Flowfields," in *Separated Flows and Jets*, ed. V.V. Kozlov and A. V. Dovgal, IUTAM Symposium, Novosibirsk, USSR, July, 1990, Springer-Verlag, Berlin, 1991.
- Alvi, F. S., and Settles, G. S., "A Parametric Study of Swept Shock Wave/Turbulent Boundary Layer Interaction Structures Using White-Light Conical Shadowgraphy," AIAA Paper 90-1644, July 1990.
- Settles, G. S., and Dolling, D. S., "Swept Shock/Boundary-Layer Interactions -- Tutorial and Update," Invited AIAA Paper 90-0375, January 1990.
- Lu, F. K., and Settles, G. S., "Upstream Influence Scaling of Fin-Generated Shock Wave Boundary-Layer Interactions," AIAA Paper 90-0376, presented at AIAA 28th Aerospace Sciences Meeting, Reno NV, Jan. 1990.

- Kim, K-S., Lee, Y., Alvi, F. S., Settles, G. S., and Horstman, C. C., "Laser Skin Friction Measurements and CFD Comparison of Weak-to-Strong Swept Shock/Boundary Layer Interactions," AIAA Paper 90-0378, presented at the AIAA 28th Aerospace Sciences Meeting, Reno, NV, January 1990.
- Deng, X-Y., and Settles, G. S., "A Test of the Independence Principle in Swept Cylindrical Shock Wave/Turbulent Boundary layer Interactions," *Acta Aerodynamica Sinica*, Vol. 7, Dec. 1989, pp. 442-448.
- Hsu, J. C., and Settles, G. S., "Holographic Interferometry of Swept Shock/Boundary Layer Interactions," presented at the 5th International Symposium on Flow Visualization, Prague, Czechoslovakia, 21-25 August, 1989.
- Settles, G. S., and Lu, F. K., "A Microcomputer-Based Data-Acquisition System for a Supersonic Wind-Tunnel Laboratory," presented at the 4th Asian Congress of Fluid Mechanics, August 19-23, 1989, Hong Kong.
- Settles, G. S., "Aerospace and Wind Tunnel Testing," Chapter 25 of *Handbook of Flow Visualization*, ed. W.-J. Yang, Hemisphere Press, Washington, 1989, (pp. 395-408).
- Settles, G. S., "Indoor Environments," Chapter 37 of *Handbook of Flow Visualization*, ed. W.-J. Yang, Hemisphere Press, Washington, 1989, (pp. 619-626).
- Naughton, J. W., Cattafesta, L. N., and Settles, G. S., "An Experimental Study of the Effect of Streamwise Vorticity on Supersonic Mixing Enhancement," AIAA Paper 89-2456, presented at the AIAA/ASME/SAE/ASEE 25th Joint Propulsion Conference, Monterey, CA, July 10-14, 1989.
- Hsu, J. C., and Settles, G. S., "Measurements of Swept Shock Wave/Turbulent Boundary Layer Interactions by Holographic Interferometry," AIAA Paper 89-1849, presented at the AIAA 20th Fluid Dynamics, Plasma Dynamics and Lasers Conference, Buffalo NY, June 12-14, 1989.
- Lu, F. K., and Settles, G. S., "Inception Length to a Fully-Developed Fin-Generated Shock Wave Boundary-Layer Interaction," AIAA Paper 89-1850 and *AIAA Journal*, Vol. 23, May 1991, pp. 758-762.
- Lu, F. K., and Settles, G. S., "Color Surface-Flow Visualization of Fin-Generated Shock-Wave Boundary-Layer Interactions," *Experiments in Fluids*, March 1990, Vol 8, No. 6, pp 352-354.
- Denger, G. R., and Settles, G. S., "A Flow Visualization Study of Silicon Wafer Spray Development Uniformity," *Proc. 19th Annual Mtg. of the Fine Particle Soc.*, Santa Clara, July 1988.
- Metwally, O. M., and Settles, G. S., "An Experimental Study of Shock Wave/Vortex Interaction," AIAA Paper 89-0082, AIAA 27th Aerospace Sciences Meeting, Reno, NV, January 9, 1989.
- Chuang, C. L., Cherng, D. L., Hsieh, W. H., Settles, G. S., and Kuo, K. K., "Study of Flowfield Structure in a Simulated Solid-Propellant Ducted Rocket Motor," AIAA Paper 89-0011, AIAA 27th Aerospace Sciences Meeting, Reno, NV, January, 1989.
- Metwally, O. M., and Settles, G. S., "Interaction of a Supersonic Streamwise Vortex and a Normal Shock Wave," 41st Annual Meeting of the American Physical Society Division of Fluid Dynamics, Buffalo, NY, November 20-22, 1988.
- Metwally, O. M., and Settles, G. S., "Measurements of a Supersonic Turbulent Vortex," *Proc. 11th Symposium on Turbulence*, Rolla, Missouri, October 17-19, 1988, Paper A31.
- Chuang, C. L., Cherng, D. L., Hsieh, W. H., Settles, G. S., and Kuo, K. K., "Flow Visualization of a Simulated Solid-Propellant Ducted Rocket Motor," *Proc. 25th JANNAF Combustion Meeting*, October 24-28, 1988, Huntsville, Alabama.

- Settles, G. S., Metwally, O. M., Hsu, J. C., and Lu, F. K., "Visualization of High-Speed Flows at the Penn State Gas Dynamics Laboratory," *Proc. 1988 International Conference on Applications of Lasers and Electro-Optics*, Santa Clara, Oct. 30, 1988, Laser Inst. of America Vol. 67, pp. 95-101.
- McIntyre, S. S., Settles, G. S., Schmidt, M. C., and Via, G. G., "A Flow Visualization Study of Nonuniformities of Wafer Development in a Recirculating Tank," *Proc. 9th International Symposium on Contamination Control*, Los Angeles, Sept. 26-30, 1988, pp. 612-615.
- Lu, F. K., and Settles, G. S., "Structure of Fin-Shock/Boundary-Layer Interactions by Laser Light-Screen Visualization," AIAA Paper 88-3803, First National Fluid Dynamics Congress, Cincinnati, OH, July 1988.
- Fung, Y-T, Settles, G. S., and Ray, A., "Microprocessor Control of High-Speed Wind Tunnel Stagnation Pressure," AIAA Paper 88-2062, AIAA Aerodynamic Testing Conference, San Diego, May 1988.
- Kim, K-S, and Settles, G. S., "Skin Friction Measurements by Laser Interferometry in Swept Shock/ Turbulent Boundary-Layer Interactions," AIAA Paper 88-0497, Jan. 1988, and *AIAA Journal*, Vol. 28, Jan. 1990, pp. 133-139.
- Kim, K.-S., and Settles, G. S., "Skin Friction Measurements by Laser Interferometry," Ch. 3 of AGARDograph No. 315, A Survey of Measurements and Measuring Techniques in Rapidly Distorted Compressible Turbulent Boundary Layers, eds. H. H. Fernholz, A. J. Smits, and J.-P. Dussauge, November 1988.
- Settles, G. S., and Via, G. G., "Measurement and Control of Particle-Bearing Air Currents in a VLF Clean Room," in *Particles in Gases and Liquids 1, Detection, Characterization, and Control*, ed. K. L. Mittal, Plenum Press, New York, 1989, pp. 185-194.
- Lu, F. K., Settles, G. S., and Horstman, C. C., "Mach Number Effects on Conical Surface Features of Swept Shock Boundary-Layer Interactions," AIAA Paper 87-1365, June 1987, and *AIAA Journal*, Vol. 28, Jan. 1990, pp. 91-97.
- Settles, G. S., Huitema, B. C., McIntyre, S. S., and Via, G. G., "Visualization of Clean Room Flows for Contamination Control in Microelectronics Manufacturing," *Flow Visualization IV*, ed. C. Veret, Hemisphere Press, 1987, pp. 833-838.
- Settles, G. S., and Via, G., "A Portable Schlieren Optical System for Clean Room Applications," in *Proc. 8th International Symposium on Contamination Control*, Milan, Italy, Sept. 1986, pp. 381-392 and *The Journal of Environmental Sciences*, Vol 30, No 5, Sept., 1986, pp. 17-21.
- Heinsohn, R. J., Yu, S. T., Merkle, C. L., Settles, G. S., and Huitema, B. C., "Viscous Turbulent Flow in Push-Pull Ventilation Systems," in *Ventilation '85*, ed. H. D. Goodfellow, Elsevier Press, 1986, pp. 529-566.
- Settles, G. S., "Modern Developments in Flow Visualization," Invited Survey Paper No. AIAA 84-1599, and *AIAA Journal*, Vol. 24, No. 8, August, 1986, pp. 1313-1323.
- Settles, G. S., Horstman, C. C., and McKenzie, T. M., "Experimental and Computational Study of a Swept Compression Corner Interaction Flowfield," *AIAA Journal*, Vol. 24, No. 5, May, 1986, pp. 744-752.
- Settles, G.S., "Recent Skin Friction Techniques for Compressible Flows," Invited Survey Paper No. AIAA 86-1099, May, 1986.
- Settles, G. S., and Kimmel, R. L., "Similarity Conditions of Conical Shock Wave/Turbulent Boundary Layer Interactions," *AIAA Journal*, Vol. 24, No. 1, January, 1986, pp. 47-53.
- Settles, G. S., "Moving Beyond Light Shows: A New Concept in Color Music Displays," *Mix Magazine*, Vol. 9, No. 10, October, 1985, pp. 48-53.



- Settles, G. S., and Lu, Frank K., "Conical Similarity of Shock/Boundary-Layer Interactions Generated by Swept and Unswept Fins," *AIAA Journal*, Vol. 23, No. 7, July, 1985, pp. 1021-1027.
- Settles, G. S., "On the Inception Lengths of Swept Shock Wave/Turbulent Boundary Layer Interactions," in *"Turbulent Shear-Layer/Shock-Wave Interactions,"* ed. J. Delery, Springer-Verlag Publishing, Berlin, 1986, pp. 203-213.
- Settles, G. S., and Dolling, D. S., "Swept Shock Wave-Boundary Layer Interactions," in "Tactical Missile Aerodynamics," eds. M. J. Hemsch and J. N. Nielsen, Vol. 104 of *AIAA Progress in Astronautics and Aeronautics* Series, September, 1986, pp. 297-379.
- Settles, G. S., "Colour-Coding Schlieren Techniques for the Optical Study of Heat and Fluid Flow," in the *International Journal of Heat and Fluid Flow*, Vol. 6, No. 1, March 1985, pp. 3-15.
- Schmidt, M. C., and Settles, G. S., "Alignment and Accuracy of the Conical Shadowgraph Flow Visualization Technique," *Experiments in Fluids*, Vol. 4, No. 2, pp. 93-96.
- Settles, G. S., "Flow Visualization Techniques for Practical Aerodynamic Testing," in *Flow Visualization III*, ed. W.-J. Yang, Hemisphere Press, New York, 1985, pp. 306-315.
- Settles, G. S., and Kuhns, J. W., "Visualization of Airflow and Convection Phenomena About the Human Body," *Bull. of the American Physical Soc.*, Vol. 29, No. 9, 1984, p. 1515.
- Settles, G. S., "Large-Field Color Schlieren Visualization of Transient Fluid Phenomena," *Bull. American Physical Society*, Vol. 28, No. 9, 1983, p. 1404.
- Settles, G. S., "The State-of-the-Art of Conventional Flow Visualization Techniques for Wind Tunnel Testing," in NASA CP-2243, eds. W. W. Hunter and J. T. Foughner, NASA, 1982, pp. 9-26.
- Settles, G. S., and Teng, H.-Y., "Cylindrical and Conical Flow Regimes of Three-Dimensional Shock Wave/Turbulent Boundary Layer Interactions," *AIAA Paper 82-987*, and *AIAA Journal*, Feb. 1984, pp. 194-200.
- Settles, G. S., and Teng, H.-Y., "Flow Visualization Techniques for 3D Shock Wave/Turbulent Boundary Layer Interactions," *AIAA Paper 82-229*, Jan. 1982, and *AIAA Journal*, March 1983, pp. 390-397.
- Settles, G. S., "Schlieren Photography," *Technical Photography*, Vol. 14, No. 2, February 1982, pp. 35-41.
- Settles, G. S., "Hidden Frenzy," (popular article on flow visualization and turbulence), *Science Digest*, Vol. 89, Aug. 1981, pp. 44-49, 117.
- Settles, G. S., Perkins, J. J., and Bogdonoff, S. M., "Upstream Influence Scaling of 2D and 3D Shock/Turbulent Boundary Layer Interactions at Compression Corners," *AIAA Paper 81-0334* and *AIAA Journal*, June 1982, pp. 782-789.
- Horstman, C. C., Settles, G. S., Williams, D. R., and Bogdonoff, S. M., "A Reattaching Free Shear Layer in Compressible Turbulent Flow - A Comparison of Numerical and Experimental Results," *AIAA Paper 81-0333*, January 1981, and *AIAA Journal*, January 1982, pp. 79-85.
- Arasteh, D. T., Nall, D. H., Harje, D. T., and Settles, G. S., "Performance of a Selective Surface Water Wall Retrofit," *Proc. 5th National Passive Solar Energy Conference*, Amherst, MA, October 19-24, 1980.
- Settles, G. S. and Bogdonoff, S. M., "Separated Flow and Boundary Layer Research," Report No. 1494, Princeton University, Mechanical and Aerospace Engineering Dept., Gas Dynamics Laboratory, October 1980.

- Settles, G. S., "Color Schlieren Optics - A Review of Techniques and Applications," Proceedings of the International Symposium on Flow Visualization, Sept. 9-12, 1980, Bochum, Germany, and *Flow Visualization II*, ed. W. Merzkirch, Hemisphere Press, New York, 1982, pp. 749-762.
- Settles, G. S., Gilbert, R. B. and Bogdonoff, S. M., "Data Compilation for Shock Wave/ Turbulent Boundary Layer Interaction Experiments on Two-Dimensional Compression Corners," Princeton University MAE Dept. Report No. 1489, August 1980.
- Settles, G. S., Carlson, A. B. and Harje, D. T., "An Optical Study of Thermal Convection in a Passive Solar Heated Room," ASME Paper 80-C2/Sol-1, 1980.
- Settles, G. S., Baca, B.K., Williams, D. R. and Bogdonoff, S. M., "A Study of Reattachment of a Free Shear Layer in Compressible Turbulent Flow," AIAA Paper 80-1408, July 1980, and *AIAA Journal*, January 1982, pp. 60-67.
- Settles, G. S., Perkins, J. J. and Bogdonoff, S. M., "Investigation of Three-Dimensional Shock/Boundary Layer Interactions at Swept Compression Corners," *AIAA Journal*, Vol. 18, No. 6, July 1980, pp. 779.
- Settles, G. S., Fitzpatrick, T. J. and Bogdonoff, S. M., "Detailed Study of Attached and Separated Compression Corner Flowfields in High Reynolds Number Supersonic Flow," *AIAA Journal*, Vol. 17, No. 6, June 1979, pp. 579.
- Settles, G. S., and Bogdonoff, S. M., "Experimental Study of Separated Flow and Turbulent Boundary Layers," Proceedings of the AFOSR Program Review on External Aerodynamics, Air Force Office of Scientific Research, Dayton, OH, June 1979.
- Settles, G. S. and Perkins, J. J., "Investigation of Three-Dimensional Shock/Boundary Layer Interactions at Swept Compression Corners," AIAA Paper 79-1498, July 1979.
- Settles, G. S., Fitzpatrick, T. J. and Bogdonoff, S. M., "A Detailed Study of Attached and Separated Compression Corner Flowfields in High Reynolds Number Supersonic Flow," AIAA Paper 78-1167, July 1978.
- Settles, G. S., Hamrick, J. T., Barr, W. J. and Summerfield, M., "The Definition of a National Program in Energy-Efficient Pump Utilization," Final Report on Contract E(04-3)-1260 with the U. S. Energy Research and Development Administration, Princeton Combustion Laboratories, Princeton, NJ, April 1977.
- Settles, G. S., Hamrick, J. T., Barr, W. J., Summerfield, M., and Gunn, M., "Energy Efficient Pump Utilization," *AIAA Journal of Energy*, Vol. 1, Jan.-Feb. 1977, pp. 65-72.
- Horstman, C. C., Settles, G. S., Vas, I. E., Bogdonoff S. M., Hung, C. M., "Reynolds Number Effects on Shock-Wave Turbulent Boundary-Layer Interactions - A Comparison of Numerical and Experimental Results," AIAA Paper 77-42, Jan. 1977.
- Settles, G. S., Vas, I. E. and Bogdonoff, S. M., "Details of a Shock-Separated Turbulent Boundary Layer at a Compression Corner," *AIAA Journal*, Vol. 14, No. 12, December 1976, pp. 1709-1715.
- Varney, A. M., Settles, G. S., Ingram, L. S. and Summerfield, M., "Quantitative Characterization of the Ignition Behavior of NOS Monopropellants for Pre-Loaded Liquid Propellant Gun Applications," Final Report on Contract N00174-76-C-0110 for U.S. Naval Ordnance Station, Indian Head, MD, Sept. 1976.
- Settles, G. S., Bogdonoff, S. M., and Vas, I. E., "Incipient Separation of a Supersonic Turbulent Boundary Layer at High Reynolds Numbers," *AIAA Journal*, Vol. 14, No. 1, Jan. 1976, pp. 50-56.
- Settles, G. S., Vas, I. E. and Bogdonoff, S. M., "Shock Wave-Turbulent Boundary Layer Interaction at a High Reynolds Number, Including Separation and Flowfield Measurements," AIAA Paper 76-164, Jan. 1976.

- Settles, G. S., et al., "An Exploratory Investigation of the Handling Sensitivity of Live Malfunctioned Stab Primers," Final Report on Contract N00174-75-C-0257 for the U. S. Naval Explosive Ordnance Disposal Facility, Indian Head, MD, December 1975.
- Settles, G. S., "An Experimental Study of Compressible Turbulent Boundary Layer Separation at High Reynolds Numbers," Ph.D. Dissertation, Aerospace and Mechanical Sciences Dept., Princeton University, Sept. 1975.
- Settles, G. S., Bogdonoff, S. M. and Vas, I. E., "Incipient Separation of a Supersonic Turbulent Boundary Layer at Moderate to High Reynolds Numbers," AIAA Paper 75-7, Jan. 1975.
- Settles, G. S. and Bogdonoff, S. M., "Separation of a Supersonic Turbulent Boundary Layer at Moderate to High Reynolds Numbers," AIAA Paper 73-666, July 1973.
- Settles, G. S., "A Two-Dimensional Color Schlieren Technique," *Image Technology*, June/July 1972, pp. 19-23.
- Settles, G. S., "A Portable Supersonic Tunnel for \$200.," Paper presented at the AIAA Northeast Student Conference, Rutgers University, New Brunswick, NJ, 1972.
- Stong, C. L. and Settles, G. S., "Schlieren Photography is Used to Study the Flow of Air Around Small Objects," *Scientific American*, Amateur Scientist Section, Vol. 224, No. 5, May 1971, pp. 118-124.
- Settles, G. S., "A New Quantitative Schlieren Technique for Use in Heat Transfer and Gas Dynamics," Paper presented at the ASME Region IV Student Conference, Durham, NC, April 1971.
- Settles, G. S., "A Four-Color Schlieren Technique with Sensitivity in All Directions," *Tennessee Engineer*, December 1970, pp. 4-9.
- Settles, G. S., "A Direction-Indicating Color Schlieren System," *AIAA Journal*, Vol. 8, No. 12, December 1970, pp. 2282-2284.
- Settles, G. S., "A Four-Color Schlieren Technique with Sensitivity in All Directions," Paper presented at the AIAA Southeastern Student Conference, Jan. 1970, the AIAA National Student Conference, October 1980, and the First IAF Student Conference, September 1971.
- Settles, G. S., "Study of a Gas Jet Flowing from a Blunt Body Counter to a Supersonic Stream," Paper presented at the ASME Region IV Conference, Clemson University, Greenville, NC, April 1969.
- Settles, G. S., "A Survey of Wing Tip Tank Drag Data," Document No.D6-22621TN, The Boeing Company, Seattle, WA, October 1968.
- Stong, C. L. and Settles, G. S., "How to Build a Wind Tunnel that Achieves Supersonic Speeds with a Vacuum System," *Scientific American*, Amateur Scientist Section, Vol. 215, No. 10, October 1966.